

# TOWARDS TO A VERSATILE TELE-EDUCATION PLATFORM FOR COMPUTER SCIENCE EDUCATORS BASED ON THE GREEK SCHOOL NETWORK

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## ABSTRACT

Now days the growing need for highly qualified computer science educators in modern educational environments is commonplace. This study examines the potential use of Greek School Network (GSN) to provide a robust and comprehensive e-training course for computer science educators in order to efficiently exploit advanced IT services and establish a modern and versatile education environment in the Greek Society. Furthermore, a preliminary questionnaire survey was performed in order to validate the adoption of GSN and also to formulate a realistic training course customized to specific and future needs of computer science educators in primary and secondary education, thus enabling them to immerse in real-world situations (i.e., school computer laboratory). Findings from this preliminary survey are also presented.

## KEYWORDS

tele-education, Greek School Network (GSN), training, computer science educators

## 1. INTRODUCTION

The Ministry of Education<sup>1</sup> (MoE) has established the strategic plan for the "Digital School", in order to modernize the education system through the use of the ICTs. In the context of the "Digital School", on-going and near future actions in both primary and secondary education evolve the wide use of innovative technologies (i.e., Web 2.0 applications tools), in order to enhance the traditional and lecture-dominant teaching methods and provide a flexible and attractive learning environment. Related actions include:

- Initiation of "Bring Your Own Device" (BYOD) methodology to primary and secondary schools.
- Installation of mobile computer laboratories with enhanced functionalities (i.e., broadband wireless access, multimedia equipment) and integration of advanced devices such as interactive whiteboards.
- Schools interconnection to municipal optical metropolitan area networks, enabling high-speed optical access to GSN.
- Interactive and experimental learning environment considering the use of (a) tablets or e-book readers, (b) low cost electronic prototyping platforms (i.e., Arduino kit, Raspberry Pi), (c) 3D printers and (d) programmable robotic and artificial intelligent systems.
- 3D visualization and interaction [1].

In order the above activities to achieve their potential goals, an updated and targeted training course should be provided to computer science educators. This will establish a flexible framework that will further promote the utilization of information and communication technology infrastructure in schools. The initial design and the conceptual framework of the training course was based on well-established practices [2], while further adjustments and improvements will be performed taking account the findings of an electronic questionnaire survey appropriate formulated [3]. The e-training course will be realized using the Greek School Network (GSN) [4]. This was an optimal solution since GSN delivers high quality and a wide range of network and telematics services to its end users [4-6].

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<sup>1</sup> <http://www.minedu.gov.gr>

This paper is organized as follows: In Section 2 an overview of GSN core and advanced services is presented. In Section 3 the basic scheme and functionality of the information system for management and monitoring the tele-education progress is briefly described. In Section 4 the conceptual framework of the training course is analyzed, while in Section 5 the evaluation of the electronic questionnaire survey is presented. Finally, conclusions are drawn in Section 6.

## 2. GSN CORE AND ADVANCED SERVICES OVERVIEW

The Greek School Network<sup>2</sup> (GSN) was founded in 1998 and constitutes the educational intranet of the Ministry of Education [4]. GSN interconnects all Greek schools, educational administration offices and organizations and also provides advanced e-services to students, teachers, and school administrator communities [5]. It was funded by the second and third Community Support Framework of the European Union and is currently maintained and supported by a group of twelve research centers and universities, under the management of Computer Technology Institute and Press “Diophantus” (CTIP)<sup>3</sup> [6]. It is the biggest national public network according to the number of users, and has been recognized internationally as a remarkable educational network that promotes the introduction and exploitation of Information and Communication Technologies (ICT) in the Greek educational system. Furthermore, due to its innovative role the GSN fulfills the scientific and research goals for the diffusion of Internet access and the promotion and establishment of contemporary educational models.

The GSN services [4] can be divided into the following categories: (i) Basic services: network connectivity, user authentication and authorization, GSN and students portal, automatic user’s registration, (ii) Communication services: email (with anti-virus and anti-spam protection), electronic lists, instant messaging, video-teleconference, (iii) Web hosting and blogging: teacher and school pages hosting, authoring tools for web pages, dynamic pages hosting, database service, blogs, (iv) Advanced services: Video on Demand (VoD), live casting, synchronous and asynchronous e-learning, e-portfolios, social networking, (v) Complementary services: electronic cards, school magazines and newspapers, team calendars, file sharing, (vi) Central infrastructure services: naming service (DNS), directory service (LDAP), distributed helpdesk, online statistics, asset management and (vii) Management services: users management service, network monitoring, network security, remote router administration, CERT, statistics, etc..

The aforementioned services have been designed to appeal to all GSN users offering a versatile environment suitable for the implementation of modern educational methodologies and the introduction of modern practices. Traditional teacher centered, lecture-dominant and text-based teaching methods can be enriched and become more attractive using GSN services. It has to be mentioned that the role of GSN is not to define the teaching methods, but to support a coherent set of well-established educational tools that can enhance and accommodate modern digital education methodologies. This implies that GSN efficiently provides a robust information and communication technology framework (i.e., high quality networking services) allowing large scale and long-term e-learning and training activities, as is described in the following sections, to be successfully realized.

As described below, feedback information extracted from an electronic questionnaire survey indicates a high adoption of the GSN services from the school community (i.e., teachers). There is particularly high utilization of electronic services, such as email, emailing lists, websites, blogs, VoD as well as of social networking and synchronous and asynchronous e-learning services. Some overall statistics (recorded February 2013) validating the broad use of GSN services are depicted in Table 1.

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<sup>2</sup> <http://www.sch.gr>

<sup>3</sup> <http://www.cti.gr>

Table 1. Statistical data of GSN

GSN services	16
Educational websites	12.747 (based on PHP, Joomla, Wordpress or ASP/.NET technology)
Educational blogs	19.223 (February 2013)
Educational communities	318
Digital Courses (current year)	4.786 courses from 891 schools of Secondary Education
GSN portal	>340.000 unique visitors per month
Personal accounts	82.120 (teachers), 63.554 (students)
Active mailboxes	>133.000
Helpdesk tickets	>30.000/year

GSN maintains a thorough tested, reliable set of services that exhibit high level of availability and scalability and its flexible architecture [4] allows the integration of the tele-education platform described below, in terms of management, authentication and authorization.

### 3. TIME SCHEDULING AND TELE-EDUCATION PLATFORM

A time Scheduling and Tele-Education Platform (t-STEP) was designed and implemented by Greek School Network and Networking Technologies Directorate<sup>4</sup> in order to provide a high quality and flexible training course and potentially compensate the growing needs on information and communication technologies. Currently, t-STEP is in pilot operation and is evaluated by the group of universities and research institutes that operate and maintain the GSN. As it is expected, production service will be available in March 2013 at <http://training.sch.gr>. Considering the initial design framework, t-STEP comprises the following:

- **Frontend module (see Figure 1):** Upon successful login (i.e., valid GSN account) time scheduling (i.e., registration in forthcoming e-lecture) and basic administration (i.e., update users' profile) operations can be efficiently performed. Also, some statistical data can be extracted (i.e., total hours of successfully attended e-lectures) and thoroughly presented to the user. Furthermore, a questionnaire survey is provided in order to evaluate, upon completion, the overall e-training process. Additionally, a link to a test-room (virtual class) is provided to verify software and hardware compatibility, in order to successfully participate in the real-time e-learning environment described below.



Figure 2. Front-end web-page of the training platform

- **Administration (backend) module (see Figure 2):** The backend environment provides the main administration interface of the t-STEP, which is only accessible by the operators of the GSN and the

<sup>4</sup> <http://www.cti.gr/nts>

registered instructors (with different administrative privileges). Also, a super user account (i.e., supervisor) is provided with enhanced administrative functionalities enabled. Basic operations such as monitoring the overall progress of the training course (i.e., successfully completed training sessions), schedule or postpone a training task, track trainees who successfully registered and participated in a training session, extract statistical data etc. are efficiently performed through the backend module.



Figure 2. Administration module of the training platform

- **Real-time tele-education environment (see Figure 3):** The realization of each training session is based on the BigBlueButton<sup>5</sup> open-source software, which is transparently integrated with the time-scheduling module described above. In principle, the administration of the real-time session is performed by the instructor (i.e., moderator), who potentially can interact with the participants (i.e., mute/unmute or eject user), upload slides to the presentation area and efficiently coordinate the related learning activities.

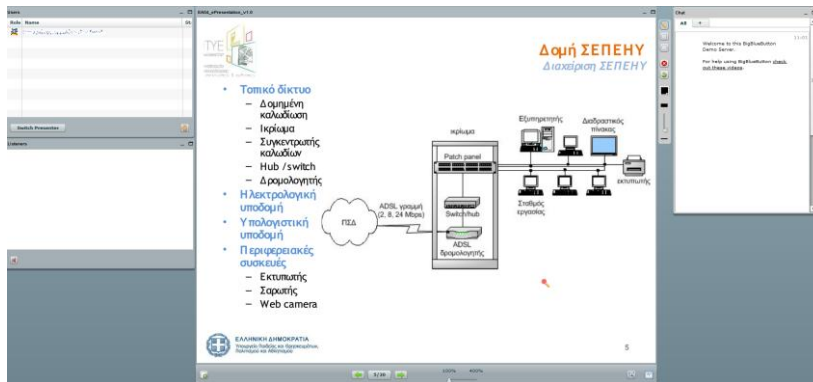


Figure 3. Typical BigBlueButton session.

Following the initial design restrictions, t-STEP is strongly oriented to the Greek educational system (i.e., primary and secondary education). Large scale deployment of the training course described below will provide critical hints for potential use (considering appropriate adjustments) in related training and life-long activities and also for advanced educational services (i.e., university post-graduate courses).

## 4. CONCEPTUAL FRAMEWORK OF THE TRAINING COURSE

The proposed framework of the training course defines 24 educational topics (ETs) organized under four categories shown in Table 2. The outline of the proposed training framework was based on the extensive and fruitful collaboration between the administrators of the GSN [4-6] and the hints that were provided by the Users Support Service (Help-Desk)<sup>6</sup>. Furthermore, useful information was also extracted from the ticketing system<sup>7</sup> utilized by the Help-Desk.

For the realization of the intended training courses and the in-depth and detailed analysis of the topics depicted in Table 2, well-documented resources designed, taking into account the adult education aspects [7], including (a) lecture notes, complemented by practical examples and case studies, (b) instructor's

<sup>5</sup> <http://www.bigbluebutton.org/>

<sup>6</sup> <http://www.sch.gr/helpdesk>

<sup>7</sup> <http://helpdesk.sch.gr>

presentation slides, (c) research topics and set of activities meriting further investigation and practice, (d) self-assignments and (e) instructor's notes. Typically selecting the correct mixture of available resources is a challenging task, however the motivation for defining the logical structure of the resources (i.e., reference material) described above, was to fulfill at least the following criteria [2]:

- Addressing the challenges of life wide and lifelong learning
- Maximize the impact of distant learning providing in-depth training
- Assessment of learning and the provision of feedback
- Enhance learning experience and learning outcome
- Expand “educational bandwidth” limiting time constraints
- Facilitate collaborative work and online discussion
- Effective content and course delivery
- Efficiently address both technical oriented tasks and pedagogical issues
- Potentially accommodate growing students enrollment in digital technologies
- Address the growing emphasis on technological issues
- Potentially augment central support services considering long-term support challenges
- Strengthen incentives for fostering digital technologies and encourage innovation

Table 2. Conceptual framework of the proposed training course

Categories	Topics
Organizational	<b>ET1</b> - The role of computer science educator in the context of “Digital School” <b>ET2</b> - Users support service (helpdesk)
Ministry of Education systems' support	<b>ET3</b> - E-school application
School Computer Laboratories	<b>ET4</b> - Administration and maintenance of school computer laboratories <b>ET5</b> - Support and management of MS-Windows based operating systems <b>ET6</b> - Windows 2003 Server administration <b>ET7</b> - Windows 2008 Server administration <b>ET8</b> - ISA server 2000 and 2004 administration <b>ET9</b> - Squid proxy/caching server administration <b>ET10</b> - Ubuntu installation and configuration in school laboratories <b>ET11</b> - Open source educational OS <b>ET12</b> - Advanced IT devices (i.e., interactive whiteboards)
Greek School Network Services	<b>ET13</b> - Email service utilizing enhanced security, communication & collaboration features <b>ET14</b> - Students services <b>ET15</b> - Open source educational services <b>ET16</b> - Web hosting <b>ET17</b> - Publishing web content using Joomla CMS <b>ET18</b> - Wordpress configuration and management <b>ET19</b> - Blogs and communities <b>ET20</b> - E-class and e-learning services <b>ET21</b> - Moodle Learning Management System <b>ET22</b> - Internet safety <b>ET23</b> - Video on demand <b>ET24</b> - Advanced services (i.e., School RSM)

The potential interest of computer science educators to excel their technical proficiency in the aforementioned topics was examined through a questionnaire survey described in Section 5.

## 5. QUESTIONNAIRE SURVEY EVALUATION

The final version of the questionnaire, which was structured after fruitful consultation with the operators of the Greek School Network, comprises two distinct parts. The first part examines: (i) the degree of awareness of the educational community for the electronic services provided by the GSN, (ii) the ICT school infrastructure and (iii) the Users Support Services (Help Desk) for the direct support regarding the connectivity to GSN or its electronic services. The related evaluation tasks are listed below:

- Q1 - Are you familiar with the Greek School Network?
- Q2 - How well informed are you on the network feasibility (networking access) and network bandwidth provided by the GSN in schools and administrative units?
- Q3 - Are you familiar with the electronic services provided by the Greek School Network?
- Q4 - Are you taking advantage of the electronic services provided by the Greek School Network?
- Q5 - Do you know where you can access documentation and official guidelines for the electronic services provided by the Greek School Network?
- Q6 - How well informed are you about the school PC laboratories and their IT infrastructure?
- Q7 - Do you know where you can access technical documentation for school PC laboratories and their IT infrastructure?
- Q8 - How well informed are you about technical support services for troubleshooting common and advanced IT failures at school PC laboratories?

The second part of the questionnaire records the potential interest of the computer science educators to be trained, in the near future, in a well-defined set of technical and educational topics, as was described in Section 4. Its organizational structure was formally based on the conceptual framework shown in Table 2.

For the realization of the survey a three-grade scale was employed [3], depicted in Table 3, while statistical data was collected by means of an electronic questionnaire administered from January 9th until February 3rd 2013.

Table 3. Comparison scale for evaluation process

Characterization		
None	Sufficiently	Considerably

The questionnaire was hosted on a GSN's web-server and posted online at <http://www.sch.gr/training>. The development of the electronic questionnaire was based on open source software LimeSurvey<sup>8</sup> v2.00+, whereas the installation and configuration was performed by the Greek School Network and Networking Technologies Directorate. In order to successfully login to the above link a valid GSN account was prerequisite, while the estimated time for the questionnaire completion was ten minutes. The questionnaire was pretested, before being widely distributed, through a pilot study which helped to identify and address possible ambiguities. Thus, suggestions and feedback from respondents improved the final structure of the survey. A total of 1469 educators participated to the questionnaire survey which corresponds to 19.13% of the overall computer science educators officially registered to the Ministry of Education. Fifty-eight participants gave incomplete answers, thus their results were excluded from the statistical analysis. Typical results of the questionnaire evaluation considering the distinct parts described above are shown respectively in Figures 4 and 5. Furthermore, a sorted list (in descending order) of the e-training topics considering the characterization "Considerably" (see Table 3) is shown in Table 4.

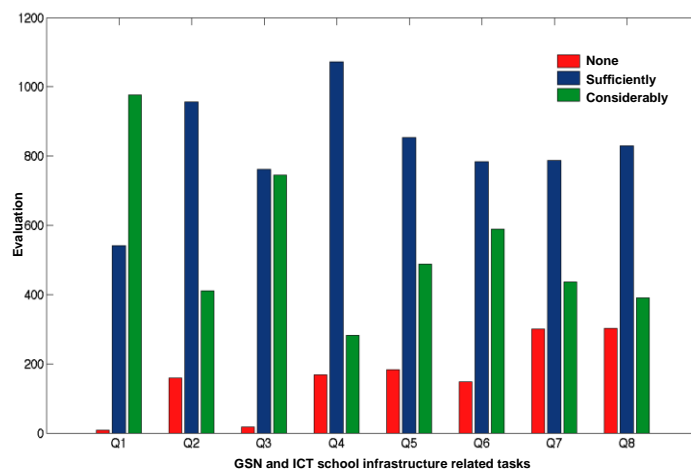


Figure 4. Survey quantitative results considering GSN, support and technical-oriented tasks

<sup>8</sup> <http://www.limesurvey.org>

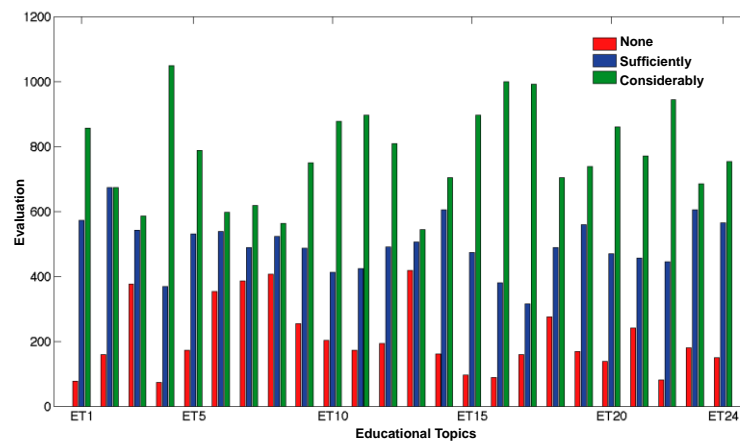


Figure 5. Survey quantitative results considering technical and educational topics shown in Table 2

Table 4. A sorted list of the e-training topics considering the characterization “Considerably”

Topics	Considerably (%)
<b>ET4</b> - Administration and maintenance of school computer laboratories	70.31
<b>ET16</b> - Web hosting	68.10
<b>ET17</b> - Publishing web content using Joomla CMS	67.55
<b>ET22</b> - Internet safety	64.24
<b>ET15</b> - Open source educational services	61.10
<b>ET11</b> - Open source educational OS	60.05
<b>ET10</b> - Ubuntu installation and configuration in school laboratories	58.78
<b>ET20</b> - E-class and e-learning services	58.58
<b>ET1</b> - The role of computer science educator in the context of “Digital School”	56.87
<b>ET12</b> - Advanced IT devices (i.e., interactive whiteboards)	54.22
<b>ET5</b> - Support and management of MS-Windows based operating systems	52.85
<b>ET21</b> - Moodle Learning Management System	52.45
<b>ET24</b> - Advanced services (i.e., School RSM)	51.36
<b>ET19</b> - Blogs and communities	50.37
<b>ET9</b> - Squid proxy/caching server administration	50.23
<b>ET14</b> - Student services	47.89
<b>ET18</b> - Wordpress configuration and management	47.89
<b>ET23</b> - Video on demand	46.59
<b>ET2</b> - Users support service (helpdesk)	44.66
<b>ET7</b> - Windows 2008 Server administration	41.45
<b>ET6</b> - Windows 2003 Server administration	40.11
<b>ET3</b> - E-school application	38.96
<b>ET8</b> - ISA server 2000 and 2004 administration	37.69
<b>ET13</b> - Email service utilizing enhanced security, communication and collaboration features	36.99

The results shown in Table 4 (as extracted from Figure 5) indicate a systematic preference for education topics related to efficient administration of school computer labs (ET4), web hosting and web content publishing using well-established CMS software (ET16 and ET17), best practices for Internet safety (ET22) and open source educational applications (ET15). Furthermore, a considerable preference for innovative educational services (ET20) and advanced IT devices (ET12) was also declared. On the other hand, lower preference was recorded for potential training in relative obsolete software (ET6 and ET7) and widely used and thoroughly tested services provided by GSN, such as the email service (ET13). Accordingly, Figure 4 indicates that GSN users are aware of the advanced electronic services offered and that are highly utilized in educational purposes. Also, a noticeable portion of the participants is able to look for documentation and official guidelines for the electronic services provided by the GSN. However, a considerable portion of the participants is unaware where can efficiently access technical documentation for school computer laboratories and their IT infrastructure and also not properly informed considering the technical support services for troubleshooting IT failures at school PC laboratories.

## 6. CONCLUSIONS

The present work introduces a time Scheduling and tele-Education Platform (t-STEP) based on the Greek School Network (GSN) and defines the conceptual framework for a technical-oriented training. A questionnaire survey was performed in order to investigate the potential technological needs of computer science educators in Greek schools (primary and secondary education) to improve their technical proficiency. Additionally, typical issues considering the GSN services and ICT school infrastructure were also examined. Preliminary results indicate a systematic preference trend in specific administrative, web-related and advanced IT training topics and furthermore validate the broad use and acceptance of GSN services. In future work a more detailed and sophisticated statistical analysis will be undertaken in order to formally describe and assess the impact and the effectiveness of the training course and potentially enhance it.

## ACKNOWLEDGEMENT

The related activities that led to these results were co-funded by National Funds and by the European Social Fund (ESF), under the Hellenic National Strategic Reference Framework (NSRF) 2007-2013. The authors gratefully acknowledge the contribution of Giannopoulos Konstantinos for the development of the electronic questionnaire, Papanikolopoulou Konstantina and Stasinou Stavroula for the graphical design of t-STEP and Limperis Antonis for his helpful suggestions.

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